

DS21354DK T1 Single-Chip Transceiver Design Kit Daughter Card

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GENERAL DESCRIPTION

The DS21354 design kit is an evaluation board for the DS21354. The DS21354DK is intended to be used as a daughter card with either the DK2000 or the DK101 motherboards. The board is complete with a single-chip transceiver (SCT), transformers, termination resistors, configuration switches, line protection circuitry, network connectors, and an interface to the motherboard.

ORDERING INFORMATION

PART	DESCRIPTION
DS21354DK	DS21354 Design Kit Daughter Card

FEATURES

- Expedites New Designs by Eliminating First-Pass Prototyping
- Interfaces Directly to the DK101 or DK2000 Motherboards
- Demonstrates Key Functions of the DS21354
- High-Level Software Provides Visual Access to Registers
- Software Controlled (Register Mapped) Configuration Switches to Facilitate Clock and Signal Routing
- BNC Connections for 75Ω E1
- Bantam and RJ48 Connectors for 120Ω T1
- Multitap Transformer to Facilitate True Impedance Matching for 75Ω and 100Ω/120Ω Paths
- Network Interface Protection for Overvoltage and Overcurrent Events
- Testpoints and Prototype Area Available for Further Customization

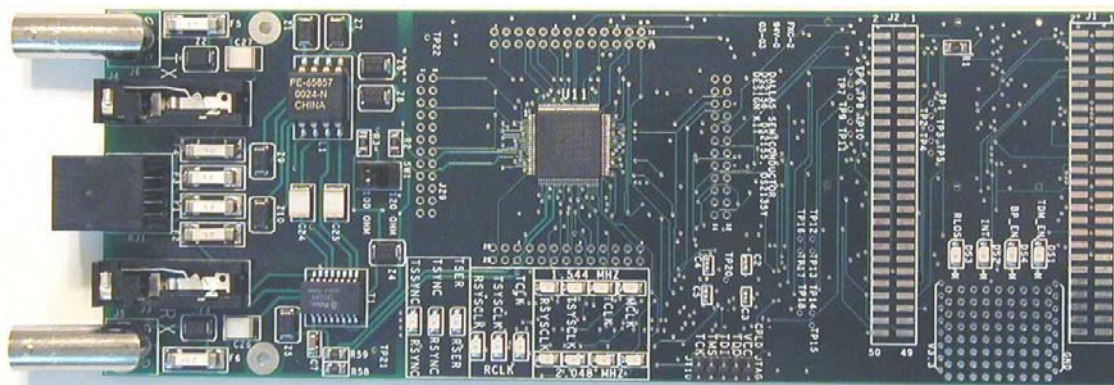


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COMPONENT LIST

DESIGNATION	QTY	DESCRIPTION	SUPPLIER	PART
C1–C5, C8–C12, C15–C19, C21, C22, C29–C34	23	0.1 μ F 10%, 16V ceramic capacitors (0603)	Digi-Key	311-1088-1-ND
C7, C36	2	1 μ F 10%, 16V ceramic capacitors (1206)	Digi-Key	PCC1882CT-ND
C13, C14	2	0.1 μ F 10%, 16V ceramic capacitors (0805)	Digi-Key	311-1142-1-ND
C23	1	0.1 μ F 10%, 25V ceramic capacitor (1206)	Digi-Key	PCC1883CT-ND
C24–C27	4	0.22 μ F, 50V ceramic capacitors	Digi-Key	UNK
C35	1	10 μ F 20%, 16V tantalum capacitor (B case)	Digi-Key	PCS3106CT-ND
DS1, DS4–DS18	16	LED, green, SMD	Digi-Key	P501CT-ND
DS2, DS3	2	LED, red, SMD	Digi-Key	P500CT-ND
F1–F6	6	250V, 1.25A fuse, SMT	Teccor Electronics	F1250T
J1, J2	2	Male 0.1, SMD, 50-pin, dual-row vertical	Samtec	TSM-125-01-T-DV
J3, J4	2	Bantam connectors	SWK	RTT34B02
J5, J6	2	Connector BNC RA 5-pin	Kruvand	UCBJR220
J7–J9	3	Socket, SMD, 50-pin, dual-row vertical	Samtec	TFM-125-02-S-D-LC
JT10	1	Connector, 10-pin, dual-row vertical	Digi-Key	S2012-05-ND
L1	1	Choke, dual 4-line 24 μ H, 8-pin SO	Pulse Engineering	PE-65857
R1, R14, R21	3	51.1 Ω 1%, 1/8W resistors (1206)	Digi-Key	P51.1FCT-ND
R2, R3, R58, R59	4	0 Ω 5%, 1/8W resistors (1206)	Digi-Key	P0.0ETR-ND
R4, R5, R60	3	51.1 Ω 1%, 1/10W resistors (0805)	Digi-Key	P51.1CCT-ND
R6, R9, R10, R13, R15–R19, R22, R23, R25–R29, R32, R37, R38, R44, R47–R49, R61	24	10k Ω 1%, 1/10W resistors (0805)	Digi-Key	P10.0KCCT-ND
R7, R8, R11, R12, R30, R31, R35, R36, R39–R43, R45, R50–R53	18	330 Ω 0.1%, 1/10W MF resistors (0805)	Digi-Key	P330ZCT-ND
R24	1	1.0k Ω 1%, 1/10W resistor (0805)	Digi-Key	P1.00KCCT-ND
R33, R34	2	NOPOP	—	NOPOP
R46	1	4.7k Ω 1%, 1/8W resistor (0805)	Digi-Key	9C08052A4701FK HFT
R54, R55	2	61.9 Ω 1%, 1/8W resistors (1206)	Digi-Key	P61.9FCT-ND
R56, R57	2	49.9 Ω 1%, 1/8W resistors (1206)	Digi-Key	P49.9FCT-ND
RJ1	1	RJ48 connector	Molex	43223
SW1	1	Switch DPDT slide 6-pin TH	Avnet	SSA22
T1	1	XFMR 16-pin SMT	Pulse Engineering	TX1099
U1–U4, U6	5	BBUS switch 10-bit CMOS, 150-mil, 24-pin SO	IDT	IDTQS3R861Q
U5	1	144-pin macrocell CPLD	Avnet	XC95144XL-10TQ100C
U7–U10	4	Quad bus switch, 150-mil, 16-pin SO	IDT	IDTQS3125Q
U11	1	T1/E1/J1 XCVR 100-pin QFP, 0°C to +70°C	Dallas Semiconductor	DS2156L
Z1, Z6–Z8	4	160V, 500A Sidactor	Teccor Electronics	P1800SCMC
Z2, Z3	2	58V, 500A Sidactor	Teccor Electronics	P0640SCMC
Z4, Z5	2	6V, 50A Sidactor	Teccor Electronics	P0080SAMC
Z9, Z10	2	25V, 500A Sidactor	Teccor Electronics	P0300SCMC

BASIC OPERATION

This design kit relies upon several supporting files, which can be downloaded from our website at www.maxim-ic.com/DS21354DK.

Hardware Configuration

Using the DK101 processor board:

- Connect the daughter card to the DK101 processor board.
- Supply 3.3V to the banana-plug receptacles marked GND and VCC_3.3V. (The external 5V connector and the TIM 5V supply headers are unused.)
- All processor board DIP switch settings should be in the ON position with exception for the flash programming switch, which should be OFF.
- From the Programs menu launch the host application named ChipView.exe. Run the ChipView application. If the default installation options were used, click the Start button on the Windows toolbar and select Programs→ChipView→ChipView.

Using the DK2000 processor board:

- Connect the daughter card to the DK2000 processor board.
- Connect J1 to the power supply that is delivered with the kit. Alternately, a PC power supply can be connected to connector J2.
- From the Programs menu launch the host application named ChipView.exe. Run the ChipView application. If the default installation options were used, click the Start button on the Windows toolbar and select Programs→ChipView→ChipView.

General:

- Upon power-up the RLOS LED is lit, as well as the MCLK-2.048MHz and TCLK-2.048MHz LEDs.
- Due to the dual winding transformer, only the 120Ω line build-out configuration setting is needed to cover 75Ω E1 and 120Ω E1.

Quick Setup (Demo Mode)

- The PC loads the program, offering a choice among Demo Mode, Register View, and Terminal Mode. Select Demo Mode.
- The program requests a configuration file, then select DS21354_E1_DSNCOM_DRV.R.cfg.
- The Demo Mode screen appears. Upon external loopback, the LOS and OOF indicators extinguish.

Quick Setup (Register View)

- The PC loads the program, offering a choice among Demo Mode, Register View, and Terminal Mode. Select Register View.
- The program requests a definition file, then select DS21354.def.
- The Register View screen appears, showing the register names, acronyms, and values. Note: During the definition file load process, all registers are initialized according to the init value filed in the definition file (because the SETUP field in the .def file is turned on).
- Predefined register settings for several functions are available as initialization files.
 - INI files are loaded by selecting the menu File→Reg Ini File→Load Ini File.
 - Load the INI file DS21354e1_fas_crc4_cas.ini.
 - After loading the INI file the following may be observed:
 - The RLOS LED extinguishes upon external loopback.
 - The device is now configured for E1 FAS with CRC4 and CAS.

Miscellaneous:

- Clock frequencies and certain pin bias levels are provided by a register-mapped CPLD, which is on the DS21354 daughter card.
- The definition file for this CPLD is named DS215x_35x_CPLD_V2.def. See the [CPLD Register Map](#) section for definitions.
- All files referenced above are available for download in the section marked “File Locations.”

REGISTER MAP

The DK101 daughter card address space begins at 0x81000000.

The DK2000 daughter card address space begins at:

0x30000000 for slot 0

0x40000000 for slot 1

0x50000000 for slot 2

0x60000000 for slot 3

All offsets given in [Table 1](#) are relative to the beginning of the daughter card address space.

Table 1. Daughter Card Address Map

OFFSET	DEVICE	DESCRIPTION
0X0000 to 0X0015	CPLD	Board identification and clock/signal routing
0X1000 to 0X10ff	Single-Chip Transceiver	Board is populated with one of the following: DS2155, DS2156, DS21352, or DS21354. Please see the data sheet(s) for details.

Registers in the CPLD can be easily modified using ChipView.exe, a host-based user interface software, along with the definition file named *DS215x_35x_CPLD_V2.def*. Definition files for the SCT are named *DS2155.def*, *DS21352.def*, or *DS21354.def*, depending on the board population option.

CPLD Register Map

Table 2. CPLD Register Map

OFFSET	NAME	TYPE	DESCRIPTION
0X0000	BID	Read-Only	Board ID
0X0002	XBIDH	Read-Only	High-Nibble Extended Board ID
0X0003	XBIDM	Read-Only	Middle-Nibble Extended Board ID
0X0004	XBIDL	Read-Only	Low-Nibble Extended Board ID
0X0005	BREV	Read-Only	Board FAB Revision
0X0006	AREV	Read-Only	Board Assembly Revision
0X0007	PREV	Read-Only	PLD Revision
0X0011	SWITCH1	Read-Write	Pin to 1.544MHz
0X0012	SWITCH2	Read-Write	Pin to 2.048MHz
0X0013	SWITCH3	Read-Write	Pin-to-Pin Connect
0X0014	SWITCH4	Read-Write	Pin-to-Pin Connect
0X0015	LEVELS	Read-Write	Set Level On Pin 1 = 3.3V

ID Registers

OFFSET	NAME	TYPE	VALUE	DESCRIPTION
0X0000	BID	Read-Only	0xD	Board ID
0X0002	XBIDH	Read-Only	0x0	High-Nibble Extended Board ID
0X0003	XBIDM	Read-Only	0x0	Middle-Nibble Extended Board ID
0X0004	XBIDL	Read-Only	0x5	Low-Nibble Extended Board ID
0X0005	BREV	Read-Only	Displays current FAB revision	Board FAB Revision
0X0006	AREV	Read-Only	Displays current assembly revision	Board Assembly Revision
0X0007	PREV	Read-Only	Displays current PLD firmware revision	PLD Revision

Control Registers

The control registers are used primarily to control several banks of FET switches that route clocks and backplane signals. Please note that certain register settings cause line contention, e.g., setting SWITCH1.4 and SWITCH2.4 both to 0 would drive MCLK with both 1.544MHz and 2.048MHz.

SWITCH1: PIN TO 1.544MHz (OFFSET = 0x0011) INITIAL VALUE = 0xF

(MSB)

(LSB)

—	—	—	—	MCLK	TCLK	RSYSCLK	TSYSCLK
---	---	---	---	------	------	---------	---------

NAME	POSITION	FUNCTION
MCLK	SWITCH1.3	0 = Connect MCLK to the 1.544MHz clock 1 = Open Switch 1.4
TCLK	SWITCH1.2	0 = Connect TCLK to the 1.544MHz clock 1 = Open Switch 1.3
RSYSCLK	SWITCH1.1	0 = Connect RSYSCLK to the 1.544MHz clock 1 = Open Switch 1.2
TSYSCLK	SWITCH1.0	0 = Connect TSYSCLK to the 1.544MHz clock 1 = Open Switch 1.1

SWITCH2: PIN TO 2.048MHz (Offset = 0X0012) INITIAL VALUE = 0x3

(MSB)

(LSB)

—	—	—	—	MCLK	TCLK	RSYSCLK	TSYSCLK
---	---	---	---	------	------	---------	---------

NAME	POSITION	FUNCTION
MCLK	SWITCH2.3	0 = Connect MCLK to the 2.048MHz clock 1 = Open Switch 2.4
TCLK	SWITCH2.2	0 = Connect TCLK to the 2.048MHz clock 1 = Open Switch 2.3
RSYSCLK	SWITCH2.1	0 = Connect RSYSCLK to the 2.048MHz clock 1 = Open Switch 2.2
TSYSCLK	SWITCH2.0	0 = Connect TSYSCLK to the 2.048MHz clock 1 = Open Switch 2.1

SWITCH3: PIN-TO-PIN CONNECT (Offset = 0X0013) INITIAL VALUE = 0xF

(MSB)

(LSB)

—	—	—	—	TSS_RS	TCL_RC	RSY_RC	TSY_RC
---	---	---	---	--------	--------	--------	--------

NAME	POSITION	FUNCTION
TSS_RS	SWITCH3.3	0 = Connect TSSYNC to RSYNC 1 = Open Switch 3.4
TCL_RC	SWITCH3.2	0 = Connect TCLK to RCLK 1 = Open Switch 3.3
RSY_RC	SWITCH3.1	0 = Connect RSYSCLK to RCLK 1 = Open Switch 3.2
TSY_RC	SWITCH3.0	0 = Connect TSYSCLK to RCLK 1 = Open Switch 3.1

SWITCH4: PIN-TO-PIN CONNECT (Offset = 0X0014) INITIAL VALUE = 0x3**(MSB)****(LSB)**

—	—	—	—	URCLK_2048	UTCLK_2048	RSER_TSER	RSYNC_TSYNC
---	---	---	---	------------	------------	-----------	-------------

NAME	POSITION	FUNCTION		
URCLK_2048	SWITCH4.3	0 = Connect UR_CLK (TSSYNC) to 2.048MHz 1 = Open Switch 4.4		
UTCLK_2048	SWITCH4.2	0 = Connect UT_CLK (TCHCLK) to 2.048MHz 1 = Open Switch 4.3		
RSER_TSER	SWITCH4.1	0 = Connect RER to TSER 1 = Open Switch 4.2		
RSYNC_TSYNC	SWITCH4.0	0 = Connect RSYNC to TSYNC 1 = Open Switch 4.1		

LEVELS: SET LEVEL ON PIN (Offset = 0X0015) INITIAL VALUE = 0x6**(MSB)****(LSB)**

—	—	—	—	—	BP_EN	PPCTDM_EN	TUSEL
---	---	---	---	---	-------	-----------	-------

NAME	POSITION	FUNCTION
—	LEVELS1.3	—
BP_EN	LEVELS1.2	0 = Enable IDT switches that connect the UTOPIA bus to daughter card header
PPCTDM_EN	LEVELS1.1	0 = Enable IDT switches that connect the TDM bus to the daughter card header
TUSEL	LEVELS1.0	0 = Set DS2156.TUSEL to enable TDM backplane 1 = Set DS2156.TUSEL to enable UTOPIA backplane

Note (DS2156 only): When the UTOPIA backplane is enabled (LEVELS.TUSEL = 1) there is a possibility for contention between the UTOPIA bus master and TSYCLK, TSER, and RSER. To avoid this, the following switches should be opened when the UTOPIA backplane is enabled: SWITCH1.0, SWITCH2.0, SWITCH3.0, and SWITCH4.1

DS21354 INFORMATION

For more information about the DS21354, please consult the DS21354 data sheet available on our website at www.maxim-ic.com/DS21354. Software downloads are also available for this design kit.

DS21354DK INFORMATION

For more information about the DS21354DK, including software downloads, please consult the DS21354DK data sheet available on our website at www.maxim-ic.com/DS21354DK.

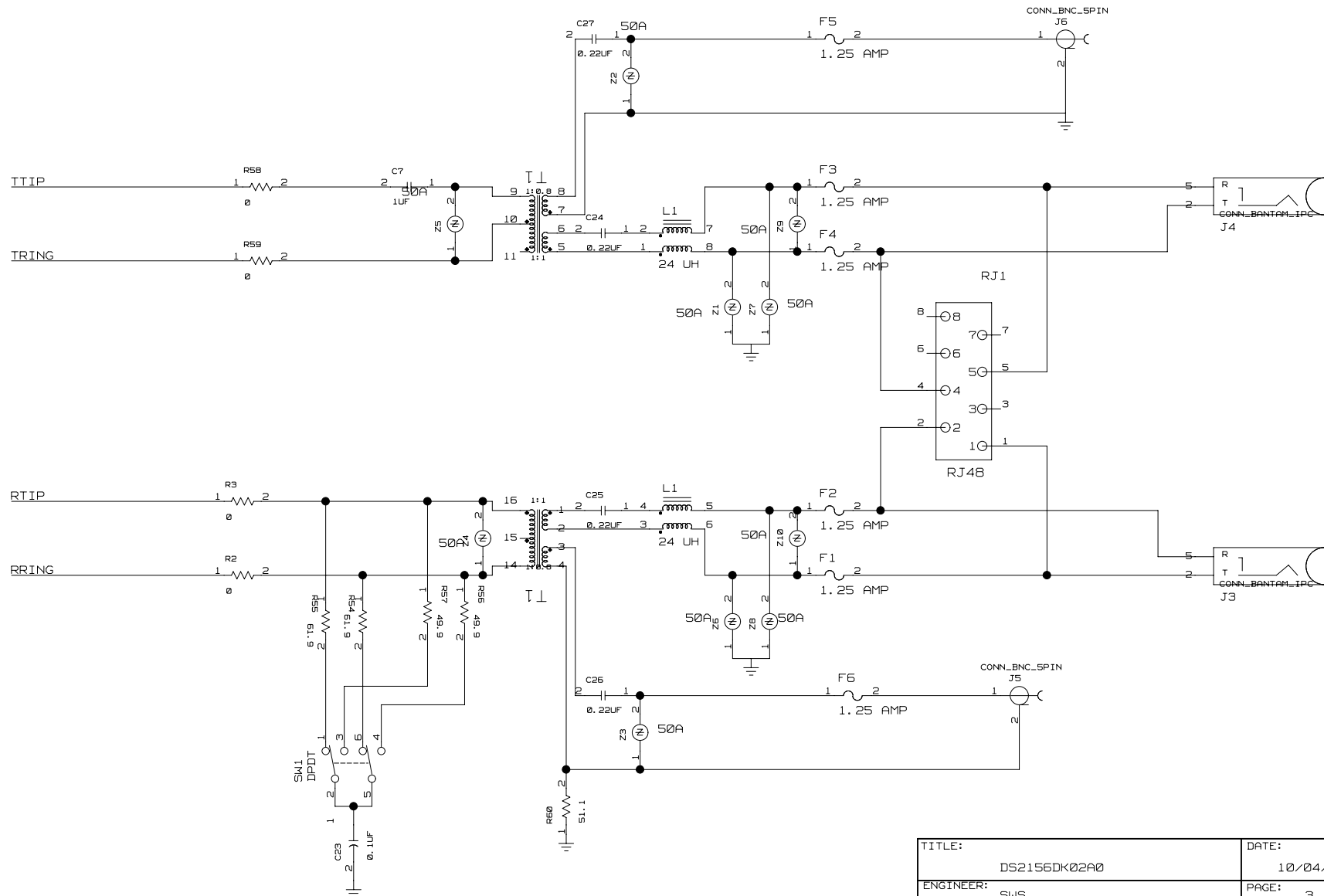
TECHNICAL SUPPORT

For additional technical support, please e-mail your questions to telecom.support@dalsemi.com.

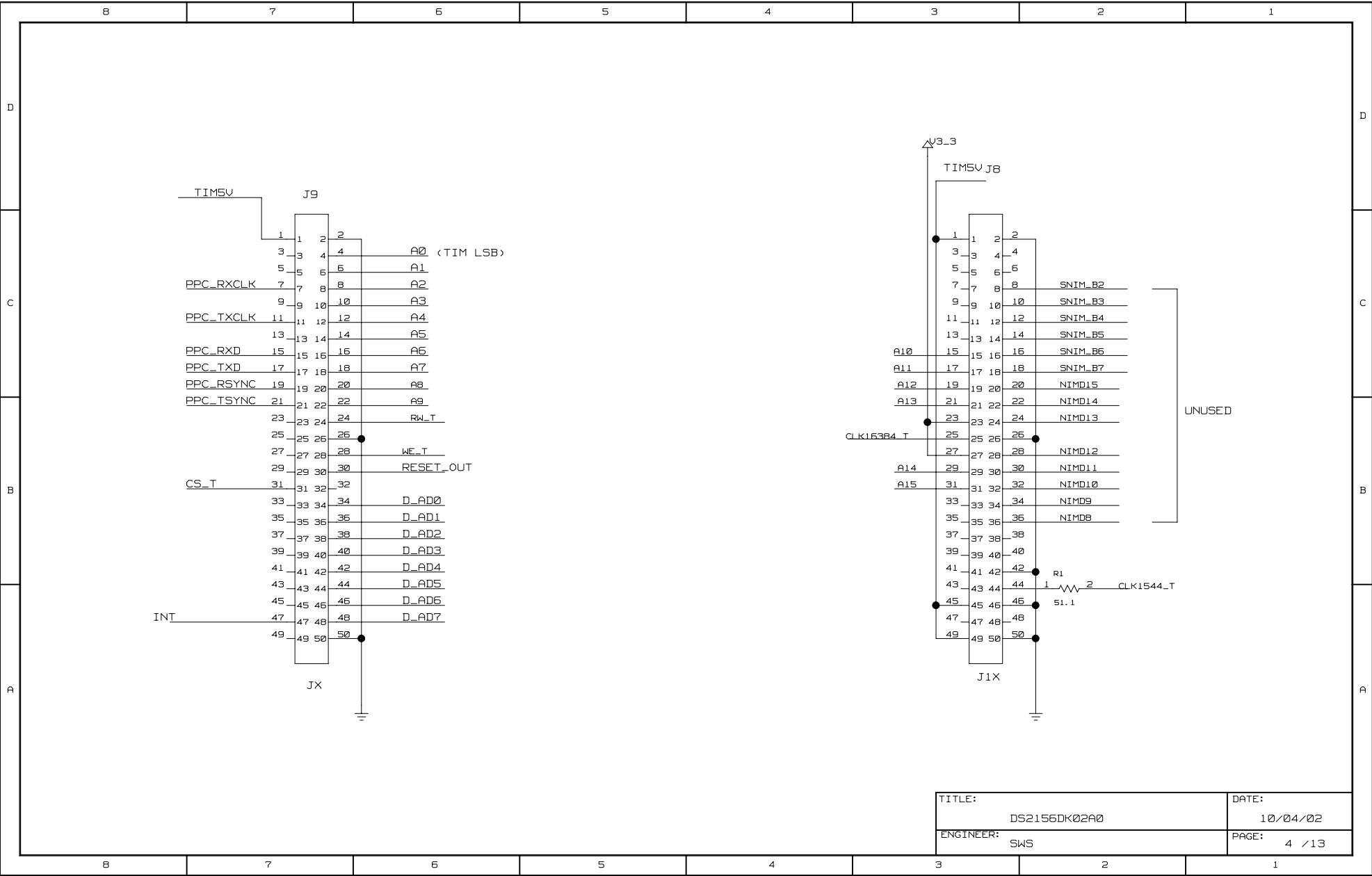
SCHEMATICS

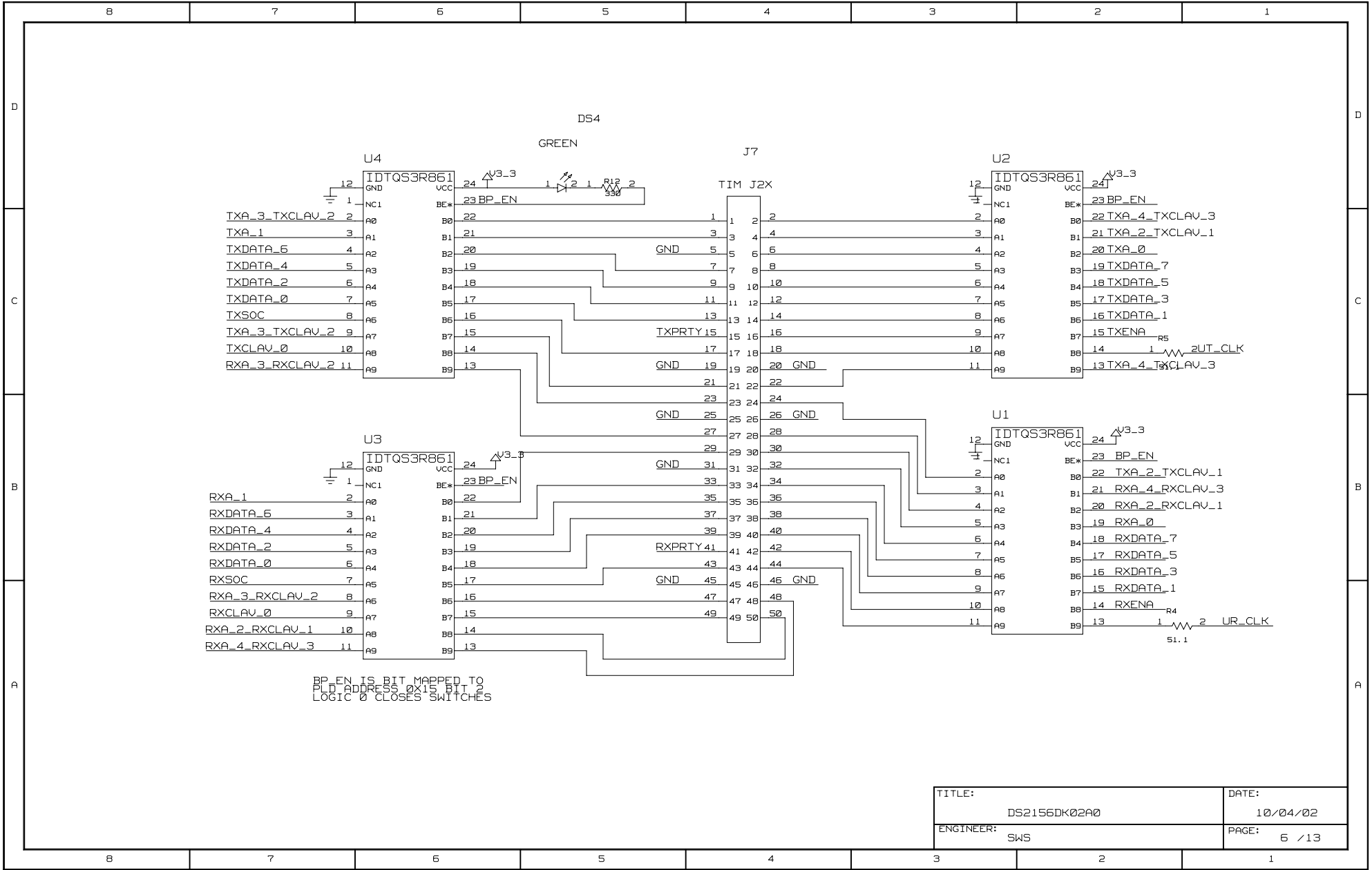
The DS21354DK schematics are featured in the following 13 pages.

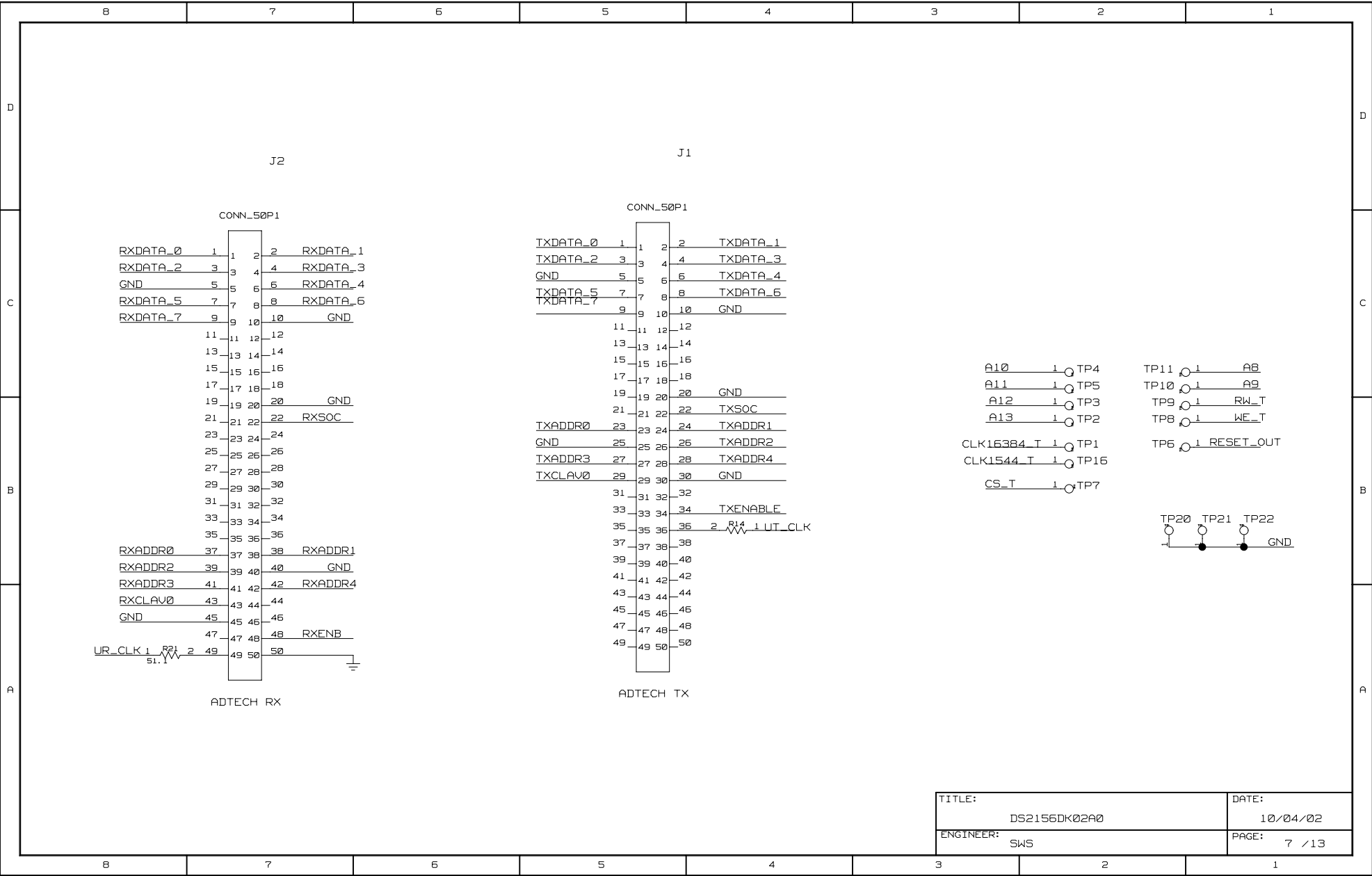
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D								
C	DS2156, DS2155, DS2135Y DESIGN KIT							
B								
A	<div>CONTENTS</div> <div>1. COVER PAGE</div> <div>2. SCT POPULATION OPTION (DS2155, DS2156, DS21352 OR DS21354)</div> <div>3. TX AND RX ANALOG PATHS</div> <div>4. TIM ADDRESS AND DATA BUS</div> <div>5. CPLD ADDRESS DATA CONNECTIONS, BIAS LEVELS FOR SCT</div> <div>6. UTOPIA: TIM HEADER AND BUS SWITCHES</div> <div>7. TESTPOINTS FOR UTOPIA 2</div> <div>8. UTOPIA: NETLIST ASSOCIATIONS</div> <div>9. SWITCHING FOR CLOCKS AND TDM</div> <div>10. SUPPLY DECOUPLING</div> <div>11. SCT TESTPOINTS</div> <div>12. NETLIST CROSS-REFERENCE</div> <div>13. PART CROSS-REFERENCE</div> <div><div>TITLE:DS2156DK02A0</div><div>ENGINEER: SWS</div><div>DATE:10/04/02</div><div>PAGE:1 / 13</div></div>							
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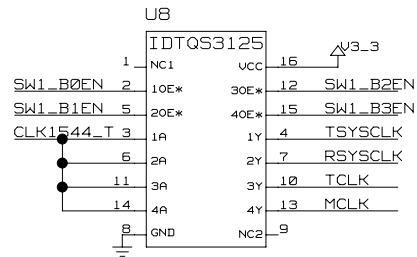


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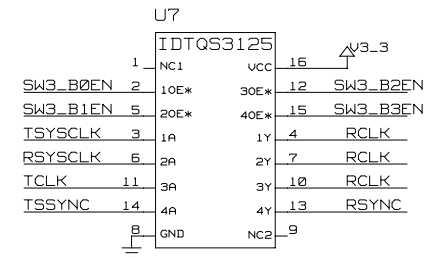




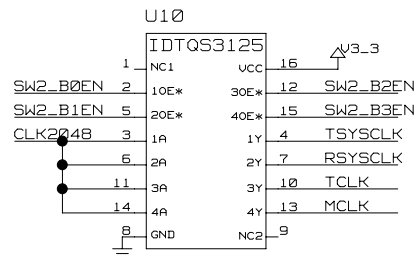




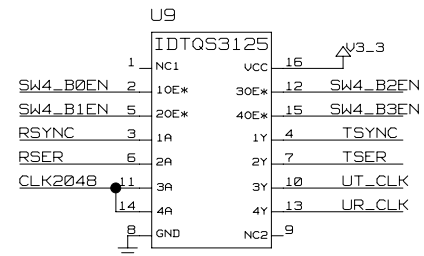
SWITCH 1 IS MEMORY MAPPED
TO PLD REGISTER 0X11
LOGIC 0 CLOSSES SWITCH
LOGIC 1 OPENS SWITCH



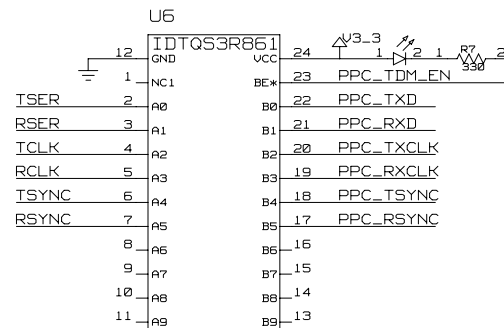
SWITCH 3 IS MEMORY MAPPED
TO PLD REGISTER 0X13
LOGIC 0 CLOSSES SWITCH
LOGIC 1 OPENS SWITCH



SWITCH 2 IS MEMORY MAPPED
TO PLD REGISTER 0X12
LOGIC 0 CLOSSES SWITCH
LOGIC 1 OPENS SWITCH



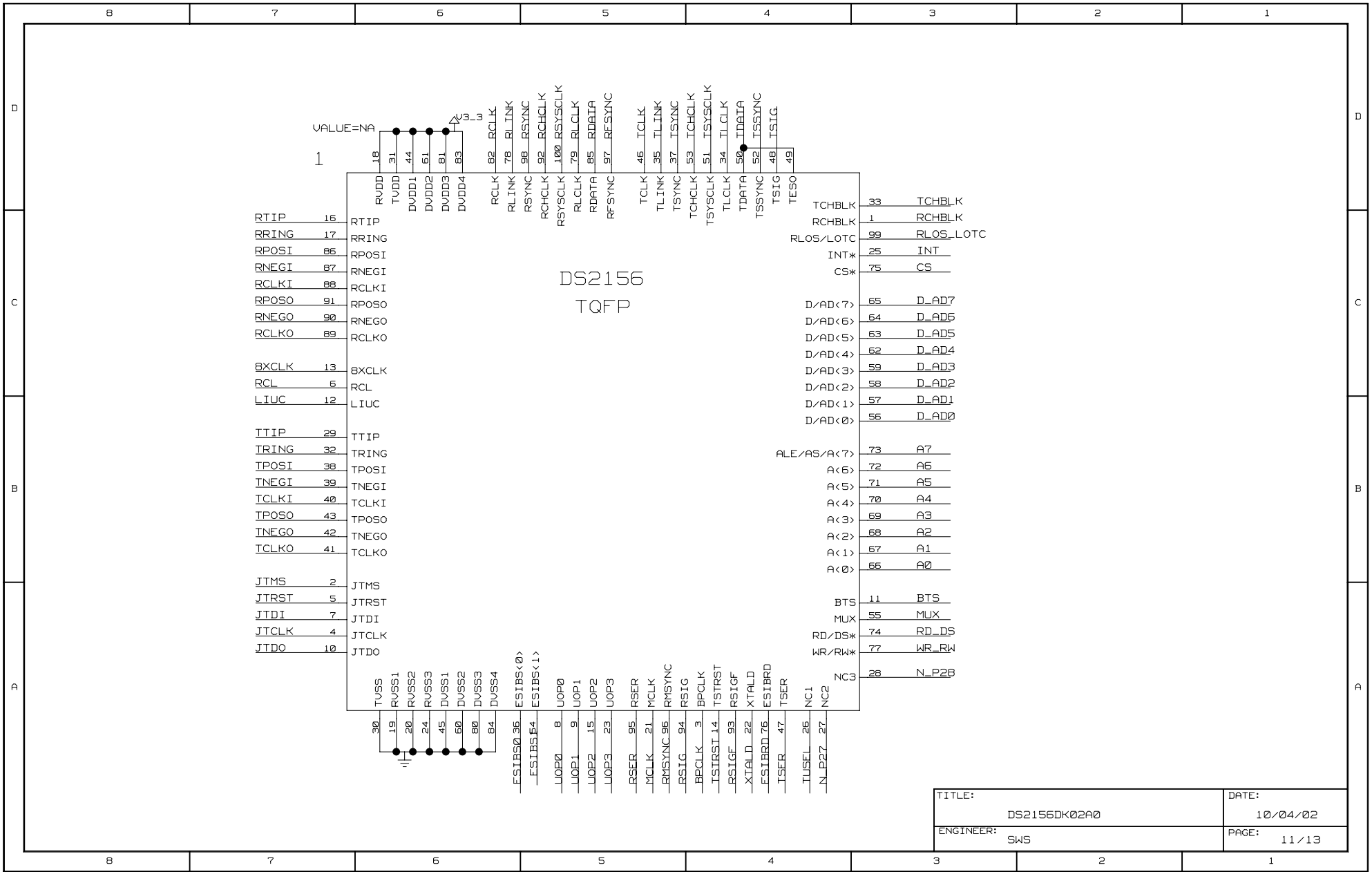
SWITCH 4 IS MEMORY MAPPED
TO PLD REGISTER 0X14
LOGIC 0 CLOSSES SWITCH
LOGIC 1 OPENS SWITCH



PPC TDM EN IS BIT MAPPED TO
PLD ADDRESS 0X15 BIT 1
LOGIC 0 CLOSSES SWITCHES

GREEN DS1

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ENGINEER:	SWS	PAGE:	9 / 13



8		7		6		5		4		3		2		1							
D	*** Part Cross-Reference for the entire design ***																				
	1	DS2156_TOFP	11D7	R7	RES	9B4	TP22	TSTPNT_SNG	7B1												
	C1	CAP	10B5	R8	RES1	5A2	TP23	TSTPNT_SNG	10A7												
	C2	CAP	10B3	R9	RES1	5A7	TP24	TSTPNT_SNG	10A8												
	C3	CAP	10B2	R10	RES1	5A7	TP25	TSTPNT_SNG	10A7												
	C4	CAP	10B2	R11	RES1	5A2	TP26	TSTPNT_SNG	10A7												
	C5	CAP	10B2	R12	RES	6D5	TP27	TSTPNT_SNG	10A7												
	C7	CAP	3D5	R13	RES1	5B6	TP28	TSTPNT_SNG	10A7												
	C8	CAP	10B4	R14	RES1	7B4	TP29	TSTPNT_SNG	10A7												
	C9	CAP	10B4	R15	RES1	5B6	TP30	TSTPNT_SNG	10A7												
C	C10	CAP	10B4	R16	RES1	5A7	TP31	TSTPNT_SNG	10A4												
	C11	CAP	10B4	R17	RES1	5B6	TP32	TSTPNT_SNG	10A4												
	C12	CAP	10B2	R18	RES1	5A6	TP33	TSTPNT_SNG	10A5												
	C13	CAP	8A1	R19	RES1	5A6	TP34	TSTPNT_SNG	10A5												
	C14	CAP	8A1	R21	RES1	7A8	TP35	TSTPNT_SNG	10A5												
	C15	CAP	10B3	R22	RES1	5A7	TP36	TSTPNT_SNG	10A5												
	C16	CAP	10B3	R23	RES1	5A7	TP37	TSTPNT_SNG	10A5												
	C17	CAP	10B2	R24	RES1	5B8	TP38	TSTPNT_SNG	10A5												
	C18	CAP	10B3	R25	RES1	5D7	U1	IDTQ53R861.U	6B3												
	C19	CAP	10B3	R26	RES1	5D8	U2	IDTQ53R861.U	6D3												
B	C21	CAP	10B2	R27	RES1	5D8	U3	IDTQ53R861.U	6B6												
	C22	CAP	10B5	R28	RES1	5A7	U4	IDTQ53R861.U	6D6												
	C23	CAP	3A6	R29	RES1	5A6	U5	XILINX_XC9572XL	5D4	5D7											
	C24	CAP	3C5	R30	RES	5A3	U6	IDTQ53R861.U	9B5												
	C25	CAP	3B5	R31	RES	5A3	U7	IDTQ53125.U	9D3												
	C26	CAP	3A5	R32	RES1	5A6	U8	IDTQ53125.U	9D7												
	C27	CAP	3D5	R33	RES1	8A1	U9	IDTQ53125.U	9B3												
	C29	CAP	10B4	R34	RES1	8A1	U10	IDTQ53125.U	9B7												
	C30	CAP	10B4	R35	RES	5A3	U11	DS2156_TOFP	2D7												
	C31	CAP	10B6	R36	RES	5A3	Z1	SIDACTOR_2	3C4												
A	C32	CAP	10B5	R37	RES1	5A6	Z2	SIDACTOR_2	3D5												
	C33	CAP	10B5	R38	RES	5A7	Z3	SIDACTOR_2	3A5												
	C34	CAP	10B5	R39	RES	5A3	Z4	SIDACTOR_2	3B5												
	C35	CAP	10B6	R40	RES	5A4	Z5	SIDACTOR_2	3C5												
	C36	CAP	10B6	R41	RES	5A3	Z6	SIDACTOR_2	3A4												
	DS1	LED	9B4	R42	RES	5A4	Z7	SIDACTOR_2	3C4												
	DS2	LED	5A2	R43	RES	5A3	Z8	SIDACTOR_2	3A4												
	DS3	LED	5A2	R44	RES1	5A7	Z9	SIDACTOR_2	3C4												
	DS4	LED	6D5	R45	RES	5A3	Z10	SIDACTOR_2	3B4												
	DS5	LED	5A3	R46	RES1	5B7															
	DS6	LED	5A4	R47	RES1	5A7															
	DS7	LED	5A3	R48	RES1	5A6															
	DS8	LED	5A4	R49	RES1	5A7															
	DS9	LED	5A4	R50	RES	5A3															
	DS10	LED	5A3	R51	RES	5B4															
	DS11	LED	5A4	R52	RES	5B4															
	DS12	LED	5A3	R53	RES	5A3															
	DS13	LED	5A3	R54	RES1	3B6															
	DS14	LED	5A3	R55	RES1	3B6															
	DS15	LED	5A3	R56	RES	3B5															
	DS16	LED	5B5	R57	RES	3B6															
	DS17	LED	5B5	R58	RES	3D7															
	DS18	LED	5A3	R59	RES	3C7															
	F1	FUSE	3B4	R60	RES	3A5															
	F2	FUSE	3B4	R61	RES1	5A7															
	F3	FUSE	3D4	RJ1	RJ48_CON	3C3															
	F4	FUSE	3C4	SK1	SWITCH_DPDT_SLIDE_6P	3A6															
	F5	FUSE	3D4	T1	XFMR_2IN_4OUT_U	3B5	3D5														
	F6	FUSE	3A3	TP1	TSTPNT_SNG	7B2															
	J1	CONN_50P1	7D5	TP2	TSTPNT_SNG	7B2															
	J2	CONN_50P1	7D7	TP3	TSTPNT_SNG	7B2															
	J3	CONN_BANTAM_IPC	3B1	TP4	TSTPNT_SNG	7C2															
	J4	CONN_BANTAM_IPC	3C1	TP5	TSTPNT_SNG	7C2															
	J5	CONN_BNC_SPIN	3A3	TP6	TSTPNT_SNG	7B2															
	J6	CONN_BNC_SPIN	3D2	TP7	TSTPNT_SNG	7B2															
	J7	CONN_50P2	6D4	TP8	TSTPNT_SNG	7B2															
	J8	CONN_50P2	4D3	TP9	TSTPNT_SNG	7B2															
	J9	CONN_50P2	4D7	TP10	TSTPNT_SNG	7B2															
	JT10	CONN_10P	5C8	TP11	TSTPNT_SNG	7B2															
	L1	CHOKE_DURL_T1	3B4	TP12	TSTPNT_SNG	5D2															
	R1	RES1	4B2	TP13	TSTPNT_SNG	5D2															
	R2	RES	3B7	TP14	TSTPNT_SNG	5A6															
	R3	RES	3B7	TP15	TSTPNT_SNG	5A6															
	R4	RES	6A2	TP16	TSTPNT_SNG	7B2															
	R5	RES	6C2	TP17	TSTPNT_SNG	5D2															
	R6	RES1	5A7	TP18	TSTPNT_SNG	5A6															
				TP19	TSTPNT_SNG	7B2															
				TP21	TSTPNT_SNG	7B1															
8		7		6		5		4		3		2		1							
TITLE: DS2156DK02A0										DATE: 10/04/02											
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